REMARKS

Review and reconsideration on the merits are requested.

The Pending Claims

Claims 1, 2 and 8. Claims 3-7 are withdrawn.

The Prior Art

U.S. 6,936,357 Melnik et al (Melnik); "Dislocation Reduction in AlN and GaN bulk crystals grown by HVPE", Albrecht et al (Albrecht).

The Rejections

Claims 1, 2 and 8 under 35 U.S.C. § 102(a) and (e) as anticipated by Melnik. Page 2 of the Action.

Claims 1, 2 and 8 under 35 U.S.C. § 102(a) and (e) as being anticipated by Melnik "as evidenced by" Albrecht. Page 3 of the Action.

Claims 1, 2 and 8 under 35 U.S.C. § 103(a) as being unpatentable over Albrecht in view of Melnik. Page 5 of the Action.

The Examiner's reading and application of the prior art to the claims herein are set forth in the Action and will not be repeated here except as necessary to an understanding of Applicant's traversal which is presented on the individual rejections after a brief introductory discussion.

The Features of the Invention

In Applicant's view, the advantageous features of the present application over Albrecht and Melnik are that the self-supported nitride semiconductor substrate has an X-ray diffraction

half width (FWHM) of 286 seconds or less in a {20-24} diffraction plane[1] as shown in Fig. 3 and Tables 2 and 3 of the specification, and the base substrate used for the self-supported nitride semiconductor substrate is made of a different material from that of the self-supported substrate as described in lines 7-8 at page 4 of the specification. Thus, the claims are amended.

Specifically, the recitation "A(a) self-supported nitride semiconductor substrate having an X-ray diffraction half width of 500 seconds or less in a {20-24} diffraction plane" in claims 1 and 8 has been changed to --A(a) self-supported nitride semiconductor substrate having an X-ray diffraction half width of 286 seconds or less in a {20-24} diffraction plane--, and the recitation "a wherein a base seed substrate used for said self-supported nitride semiconductor substrate is made of a different material from that of said self-supported substrate" has been inserted after the last end of each characterizing clause of claims 1 and 8.

Measurement of FWHM of a GaN Crystal

Applicants respectfully submit that it would be commonly accepted in this art as involving technical common sense that measurement of the FWHM of a GaN crystal would be carried out in the (0002) plane as described in the following Documents (1) to (3) submitted herewith:

Document (I): U.S. 2004/0139912 Al, paragraph [0109], lines 18-19,

Document (2): U.S. 2004/0226503 Al, paragraphs [0195] and [0200], and

Document (3): WO 2005/122232 Al, page 5, lines 28-29 and 39; page 19, lines 29-30; and page 20, lines 30-31.

[1] Applicants use { } and ( ) interchangeably herein

Applicants further submit that one of ordinary skill in the art would find it to be a technically reasonable conclusion that a change in the diffraction plane to be measured would naturally result in changes in the FWHM value.

As background, Albrecht teaches that the FWHM for (ω, 2θ) scans of (0002) and (11-24) reflections are pronouncedly different (see page 455, lines 1-3 of Albrecht).

Accordingly, one of ordinary skill in the art would reasonably conclude that an FWHM of 60-360 arcsec in a plane not clearly disclosed in Melnik should be a value of the FWHM in a (0002) plane (see claim 4 and column 11, lines 32-35, of Melnik). Accordingly, Melnik fails to teach or suggest the FWHM value in a {20-24} diffraction plane.

Anticipation Rejection of Claims 1, 2 and 8 over Melnik

The main distinguishing features of the present invention reside in realizing for the first time that the formation of a self supported nitride semiconductor substrate which simultaneously not only has a large size, namely a thickness of 200 μm or more and a diameter of 10 mm or more, but also has an X-ray diffraction half width of 286 seconds or less in a {20-24} diffraction plane as claimed can be achieved using a seed substrate made of a different material from that of the self-supported substrate, thereby providing LED devices each having an emission power of more than 5.0 mW formed on the self-supported nitride semiconductor substrate (see Fig. 3 of the specification).

To obtain the self-supported nitride semiconductor substrate of the present invention, as described, for instance, in the Examples of the present application, it is necessary to perform the following steps: forming a first nitride semiconductor layer on a base substrate, forming a mask layer with openings having a specified area at a specified density, forming a second nitride semiconductor layer on the mask layer, and removing the base substrate, the first nitride

semiconductor layer and the mask layer, respectively, to permit the second nitride semiconductor layer to remain and subjecting it to conversion to a self-supported nitride semiconductor substrate, thereby realizing the formation of the self-supported nitride semiconductor substrate as mentioned above (see page 3, line 21 to page 4, line 3 of the specification).

In contrast to the above features of the present invention, a detailed analysis of Melnik shows that the process disclosed in any one of Embodiments 1-3 of Melnik comprises forming a GaN layer on a SiC seed substrate with no intermediate layer that has been deposited on the seed substrate, and thereafter removing the SiC seed substrate to form a GaN seed substrate, followed by forming a thick GaN boule on the GaN seed substrate and slicing or cutting the resultant GaN boule to produce a plurality of GaN wafers (substrates).

In the process disclosed in the Examples of the present specification, the objective GaN layer is formed via a first nitride semiconductor layer and a mask layer with a specified structure formed on a base substrate made of a different material from that of the self-supported substrate, whereas in the process of Melnik, the objective GaN layer is formed directly on a base substrate (SiC substrate) made of a different material from that of the growing GaN substrate, which features are completely different from those of the present invention.

The process of Melnik does not involve any technical concept of the use of an intermediate layer between a base substrate (SiC substrate) made of a different material and the objective GaN layer formed thereon, and, accordingly, it would seem that the GaN layer of Melnik could not possibly have an X-ray diffraction half width (FWHM) of 286 seconds or less in a {20-24} diffraction plane.

Further, Melnik teaches with respect to the desired GaN seeds obtained from the GaN layers grown on the SiC seed substrates that they have a 300 arc seconds value for FWHM for

(0002) GaN reflection (see column 11, lines 34-35 of Melnik). Thus, even though the FWHM for the {20-24} plane might be almost equal to that for the (0002) plane, (though this is not certain) it is clear that a thin GaN layer grown on the GaN seed substrates could not achieve the X-ray diffraction half width (FWHM) of 286 seconds or less in a {20-24) diffraction plane of the present invention.

In more detail, Melnik discloses that the GaN seed substrate formed by growing GaN layers on the SiC seed substrates has an FWHM of 300 seconds in a (0002) plane (see col. 11, lines 34 and 35 of Melnik).

However, there is a tendency to have a larger value of FWHM in a {20-24} unsymmetric diffraction plane than that in a {0002} symmetric diffraction plane as shown in Table A below, which is set forth in the DECLARATION dated September 20, 2006.

Specifically, it is clear that even if the X-ray diffraction half width has a value of 250 seconds or more in a {0002} symmetric diffraction plane, there occurs a case where the X-ray diffraction half width in a {20-24} diffraction plane or a {11-24} diffraction plane has a small value of less than 500 seconds (Example 1 and Example 2). Further, even if the X-ray diffraction half width has a value of 250 seconds or less in a {0002} symmetric diffraction plane, there occurs a case where the X-ray diffraction half width in a {20-24} diffraction plane or a {11-24} diffraction plane has a high value of more than 500 seconds (Comparative Example 1 and Comparative Example 2).

Table A

No.	X-Ray Diffraction Half Width (second)		
	(20-24) Plane	(11-24) Plane	(0002) Plane
Example 1	278	286	275

Example 2	322	336	254
Comparative Example 1	550	568	125
Comparative Example 2	820	845	54

Therefore, it is considered that an FWHM for the GaN seed substrate of Melnik in a {20-24} diffraction plane would be more than at least 300 seconds.

Further, although Melnik teaches that a full width at half maximum (FWHM) of an X-ray rocking curve for the AlGaN single crystal is within a range of 60 to 360 arc seconds (see column 15, lines 15-17 (claim 4) of Melnik), as is clear from the description of Embodiment 3 of Melnik, this range is defined for the FWHM of a plurality of sliced GaN substrates from the thick GaN boules grown on the GaN seed substrates, which have features different from the X-ray diffraction half width (FWHM) of the self-supported nitride semiconductor substrate grown on a base substrate made of a different material from that of the self-supported substrate as claimed herein.

Accordingly, Applicants respectfully submit that one of ordinary skill in the art, referring to Melnik, which does not teach or suggest the main distinguishing features of claim 1 as discussed above, would not find claim 1 to be anticipated by Melnik.

Withdrawal is requested.

Applicant relies upon their arguments regarding claim 1 to support the patentability of claim 2.

Claim 8 calls for a light-emitting nitride semiconductor device comprising an epitaxial nitride layer with a light-emitting device structure formed on a self supported nitride

semiconductor substrate of the amended claim 1, and, accordingly, the amended claim 8 is not anticipated by the same reasons as discussed in the amended claim 1.

Withdrawal is requested.

Rejection of Claims 1, 2, and 8 as anticipated by Melnik "as evidenced by Albrecht"

Applicant's believe their earlier discussion establishes that claim 1, 2 and 8 are not anticipated by Melnik.

Applicants further believe that their earlier discussion further established that Albrecht teaches that the FWHM for (ϖ, 2θ) scans of (0002) and (11-24) reflections are pronouncedly different (see page 455, lines 1-3 of Albrecht).

Albrecht teaches an actually realized size of 7 x 6 x 0.1mm^3 at the maximum (see page 454, lines 7-8 in Experimental of Albrecht), though Albrecht describes an X-ray diffraction half width of 110-180 arc seconds in a {11-24} diffraction plane.

Thus, Albrecht fails to teach or suggest the formation of a self-supported nitride semiconductor substrate having the main distinguishing features of claim 1, which simultaneously satisfies not only a large size, namely a thickness of 200 μm or more and a diameter of 10 mm or more, but also has an X-ray diffraction half width of 286 seconds or less in a {20-24} diffraction plane.

Applicants thus respectfully submit that the "evidence" provided by Albrecht in no fashion improves the Examiner's anticipation rejection over Melnik alone and their position on anticipation remains essentially the same as with respect to the anticipation rejection of Melnik alone.

Withdrawal and allowance is requested.

Rejection of Claims 1, 2 and 8 as obvious over Albrecht in view of Melnik

The Examiner states in lines of 14-20 at page 6 of the Office Action that:

"It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to grow the nitride semiconductor as taught by Albrecht et al. comprising a FWHM of less than 500 microns at {11-24} and inherently {20-24}, to a diameter of 10 mm or more, because Melnik et al. have shown that nitride semiconductor crystals of these diameters are grown in the art with HVPE, (the same method of Albrecht et al.), and it has been shown that a desire to grow larger crystals is present."

However, the Examiner's statement not believed to be correct for the following reasons.

Specifically, in the case where a self-supported nitride semiconductor substrate is produced using a base seed substrate made of a different material from the nitride semiconductor substrate, strain is caused due to a mismatch of crystal lattices and a difference in the thermal expansion coefficients between the seed base substrates and the nitride semiconductor layers grown thereon, and the strain increases as the diameter of the base seed substrate increases, thereby causing the generation of dislocation lines or cracks in the crystals and the breakage of the nitride semiconductor substrate.

Evidence supporting the features mentioned above is clearly found in the comparison of FWHM values of GaN crystals each described in Albrecht and Melnik, respectively.

Specifically, in the small size product of Albrecht, an FWHM of a GaN bulk crystal having about a 100 μm diameter formed on an SiC base substrate in a (0002) plane is 91 arc seconds (see Table 1 at page 454 of Albrecht), while in the large size product having about a 6 cm diameter of Melnik, the FWHM of GaN seed substrate crystals formed on the SiC base substrates in a (0002) plane is 300 arc seconds (see column 11, lines 34-35 of Melnik), which

clearly establishes that as the diameter of a substrate increases, the quality of the GaN crystals decreases.

As a consequence, one of ordinary skill in the art referring to Albrecht, which merely teaches an FWHM of 91 arc seconds for a GaN bulk crystal having a small diameter formed on a SiC base substrate in a (0002) plane, and Melnik, which teaches an FWHM of 300 arc seconds for a GaN bulk crystal having a large diameter formed on a SiC base substrate in a (0002) plane, would not find a self-supported nitride semiconductor substrate which simultaneously satisfies not only a large size, namely a thickness of 200 μm or more and a diameter of 10 mm or more, but also has an X-ray diffraction half width of 286 seconds or less in a {20-24) diffraction plane as claimed in claim 1 to be obvious over Albrecht even if combined with Melnik.

Applicants rely upon their arguments for patentability regarding claim 1 or claim 2.

For claim 8, their arguments are essentially the same as with respect to claim 1.

Withdrawal is requested.

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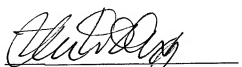
Respectfully submitted,



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